DOCUMENT RESUME

ED 280 421 HE 020 273

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TITLE Designing an Information Center: An Analysis of Markets and Delivery Systems. AIR 1986 Annual Forum Paper.
PUB DATE Jun 86
NOTE 16p.; Paper presented at the Annual Forum of the Association for Institutional Research (26th, Orlando, FL, June 22-25, 1986).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Oriented Programs; Databases; *Delivery Systems; Higher Education; *Information Centers; Information Needs; *Institutional Research; Research Utilization; Users (Information); *Use Studies
IDENTIFIERS *AIR Forum; *University of Minnesota Twin Cities

ABSTRACT

The role of information research centers in institutional research activities was explored, based on 1,040 requests for student data at an information center at the University of Minnesota, Twin Cities, during 1980-1985. Three distinct information center markets were identified and mechanisms for serving each market were recommended. The first was the routine clerical market, needing fairly simple list processing of individual cases (students) in specified subgroups. This market was the largest one for the center and was best served with downloads of selected information to microcomputers. The second was the complex clerical market needing complex computed reports of individual cases. This market was growing and was best served through rapid prototyping of mainframe production reports. The third was the decision support market, needing summary statistics across many subgroups. This market was the traditional one served by institutional research and had a strong need for data interpretation services. It was best served by traditional research reports and factbooks, as well as on demand production reports and a summary statistics database. Attention was directed to ways that old and new style information center functions can be integrated. (SW)

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ED280421

Designing an Information Center: An Analysis of Markets and Delivery Systems

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U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

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Paper presented at the 26th Annual Forum of the Association for Institutional Research
Orlando, Florida June, 1986

HE 020 273

for Management Research, Policy Analysis, and Planning

This paper was presented at the Twenty-Sixth Annual Forum of the Association for Institutional Research held at the Marriott Orlando World Center, Orlando, Florida, June 22-25, 1986. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum Papers.

Ann K. Dickey, Chair
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Abstract

The information center has been suggested as a major new function for institutional researchers. Using data from 5 years of requests to a student information center and the experiences of demographic data services, three distinct information center markets are identified and mechanisms for serving each market are suggested: (1) The routine clerical or "blue collar" market, needing fairly simple list processing of individual cases in specified subgroups. This market is the largest one for an information center and is best served with downloads of selected information to microcomputers. (2) The complex clerical or "white collar" market needing complex computed reports of individual cases. This market is growing and is best served through "rapid prototyping" of mainframe production reports. (3) The decision support or "boardroom" market, needing summary statistics across many subgroups. This market is the traditional one served by institutional research and has a strong need for data interpretation services. It is best served by traditional research reports and factbooks, as well as "on demand" production reports and a summary statistics database.

Acknowledgements

Thanks are extended to John Kellogg of Data and Reporting Services, who retrieved and analyzed data on the office's requests. An earlier version of this paper was presented at the annual conference of the Association for Insitutional Research of the Upper Midwest, La Crosse, Wisconsin, October, 1985.

Introduction

Since 1980, an important concept in data processing has been the information center, an organization especially designed for rapid response to users' information needs. Several authors have suggested that the information center can and should be an institutional research function. Lasher (1983) called attention to the information center as a way of responding to the challenge of microcomputing on campus. Stevenson and Walleri (1983) detailed the rationale for an information center as an institutional research activity and outlined roles an information center might play in institutional planning. Staman and Litaker (1985) described a process for implementing an information center as part of an institutional research office, including practical issues of staffing, space, and equipment.

The purpose of this paper is to further define the role of information centers in institutional research activities. The paper advances two hypotheses:

(1). There are distinctive markets for information center activities within the university, and

(2). Different services, products, and delivery mechanisms are needed to serve each market.

The discussion draws from two sources of data. The market segmentation hypothesis derives from an analysis of five years of requests to a student information center at the University of Minnesota, Twin Cities. The discussion of delivery mechanisms draws from an area at the cutting edge of information delivery technology--demographic analysis systems for market planning.

Background: The Evolution of the Information Center Concept

Definition of an Information Center

Information centers differ considerably in their activities, organization, and tools. There is however, a core set of characteristics shared by almost all (Martin 1982; Dooley, 1985):

- The purpose of an information center is to facilitate the rapid retrieval of data to meet ad hoc information requests.
- The center relies on special reporting databases, apart from operational databases. These databases are usually relational and structured for fast and economical retrieval of data for individual subgroups.
- Data are retrieved and manipulated using fourth-generation computer languages. Fourth generation languages use English-like commands and macro procedures to execute many individual operations at once. Examples include database packages like NOMAD and and Focus and statistical languages like SAS.
- The center gives end-users direct access to data, allowing them to manipulate the data themselves in order to answer their own questions.
- The center consults with users on questions of hardware, software, and analysis techniques.

The idea of information centers has gained momentum in data processing circles. Information centers have appeared in all types of organizations, public and private, large and small. Information center staff have their own professional association, journal, and conferences.

Two factors came together to fuel the information center movement: An increasing backlog of information requests to data processing departments and the microcomputer revolution. End users were demanding more information applications at the same time they were gaining the tools to develop their own applications. The information center was a natural response.

New Style vs. Old Style Information Centers

Institutional researchers may question the notion that information centers are really a new idea. Many would argue that institutional research offices have been information centers for a long time. The argument has merit. Dooley (1985, pg. 18) quotes Theodore Kline, a consultant on end-user computing:

> "Information center concepts are really a continuation of an internal consulting staff; they have been around for 15 or 20 years. They have been called everything from management science, management services, operations analysis to decision support services, the term information center is just a description of service to end-users."

An examination of the characteristics of information centers shows that several have been traditional institutional research functions. Certainly, rapid response to ad hoc information requests (especially from central administrators) has been a hallmark of most institutional research offices. Institutional researchers are also old hands at using extract data files and some fourth generation computer languages, namely statistical packages. Finally, institutional researchers have, by definition, been oriented toward end-users. Most consult with end-users on the nature of their information needs, data analysis techniques, and the meaning and implications of data.

The main difference between traditional institutional research functions and those of the information center is the emphasis on microcomputing and direct data manipulation by end-users. Until recently, most institutional research offices were what might be termed "old style" information centers.

Old style information centers are those which respond rapidly to ad hoc requests by having their own staff retrieve and/or analyze data for users. New style information centers emphasize direct data retrieval and analysis by end-users. The question for institutional research offices is not whether to become information centers; rather it is the degree to which they should move from being old style information centers to being new style information centers.

The remainder of this paper considers how old style information center functions can be integrated with new ones. It addresses the question of what a university information center should do for what clients using what delivery mechanisms.

Understanding Information Markets: An Analysis of Requests to an Old-Style Information Center.

In 1976, the Admissions and Records office of the University of Minnesota developed a pioneering information center for student record information, the Data Retrieval Center (now called Data and Reporting Services). The center was designed to permit fast ad hoc retrievals of student record information at a low cost. It was instituted because the production data files of student record information were not structured for ad hoc inquiry about subgroups and were too large to be accessed economically for small requests. The center has its own programmers and a flat rate billing per-program billing policy which effectively subsidizes small requests.

The center has all the characteristics of the old-style information center: It uses a special reporting database (built with the SYSTEM 2000 database management system) with many keys, thereby allowing easy retrieval of subgroup data. Early fourth generation query languages (SYSTEM 2000 Reportwriter & Plex) and analysis languages (SAS & SPSS) are used. A major staff activity is consulting with users to refine their needs and to educate them with regard to the possibilities and problems connected with using student record data. The center is now dealing with the transition from old-style to new-style information center.

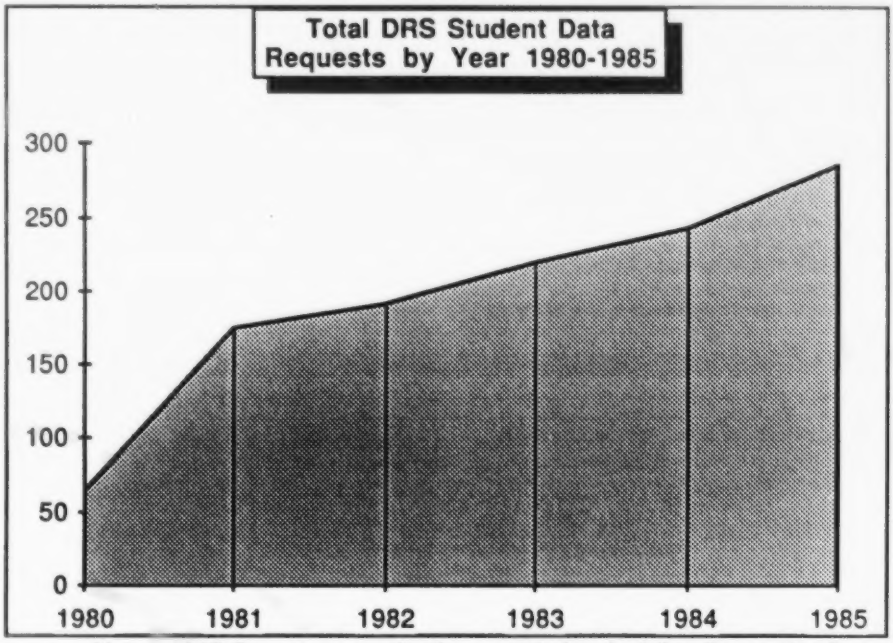
The center has been in existence long enough to yield an empirically based analysis of the student information needs of various groups on campus. The center has kept track of each request, including who made the request and what kind of information was requested. These request records are a useful source of data for understanding the markets for information center services. The data are, of course, limited to student information. Some of the marketing inferences, however, may be generalizable to other kinds of institutional data.

The analyses are based on 1,040 requests made to Data and Reporting Services from January 1980 through June, 1985. Earlier data are not included because they were judged to be less useful for understanding recent request trends.

Findings

Chart 1 shows the total number of requests made to Data and Reporting Services broken out by calendar year. The chart illustrates the trend that is found in almost all organizations: More people want more information.

Chart 1



Note: 1985 figures are projections made by doubling figures for first 6 months of the year.

Chart 2 shows the total volume of requests broken out by request type. For this analysis, requests were categorized into four types defined as follows:

I. Routine Clerical Requests which require straightforward listings of current information for subgroups of individual cases (students)defined with already-existing selection criteria. These requests do not require recomputations, or complex formatting and are typically accomplished in under two hours. Examples are mailing label/list requests for a department and honors/probation reports listing students in order of GPA for a college.

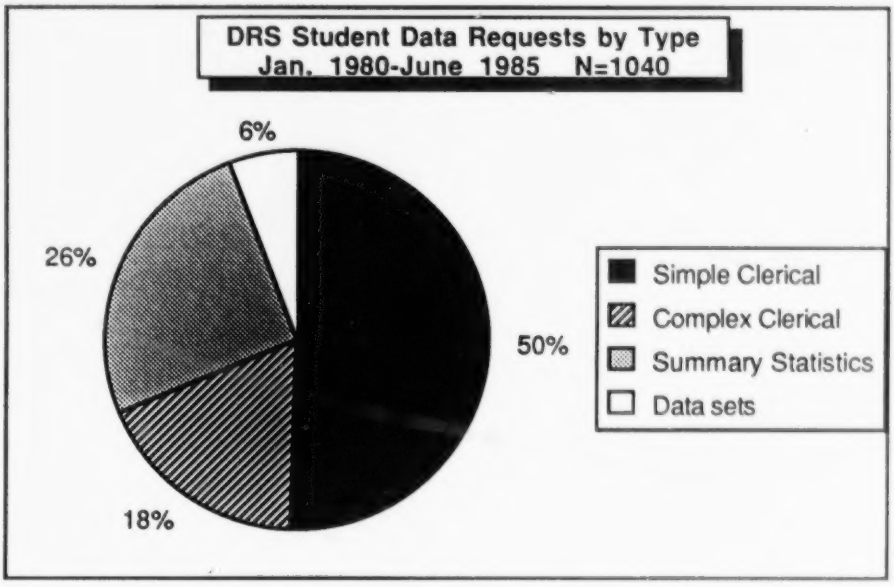
II. Complex Clerical Requests which ask for reports on individual cases, but require complex formats (several variables on a page), selection criteria (multiple or calculated criteria), or calculations (computing new variables). These reports typically require more than two hours of programming. Examples are stratified random samples, degree progress reports which compare students' coursework against degree requirements, and probation reports using multiple performance indices.

III. Summary Statistics Requests which require summary statistics rather than reports of individual cases. These requests require the use of statistical procedures, ranging from routine crosstabs to complex regression and log-linear analyses. Examples include demographic profiles and retention/GPA reports for student subgroups.

IV. Data Sets Requests which ask for individual case data in machine readable form. The data sets range from small sets downloaded to microcomputers to very large sets put on tape for mainframe applications.

Some requests required more than one type of output. In these cases the decision rule was to classify the requests upward in the sequence. For example, if a request asked for both a roster and summary statistics it was classed in the statistics category. If it asked for statistics and a data set, it was classed as a data set request. Each request was counted only once.

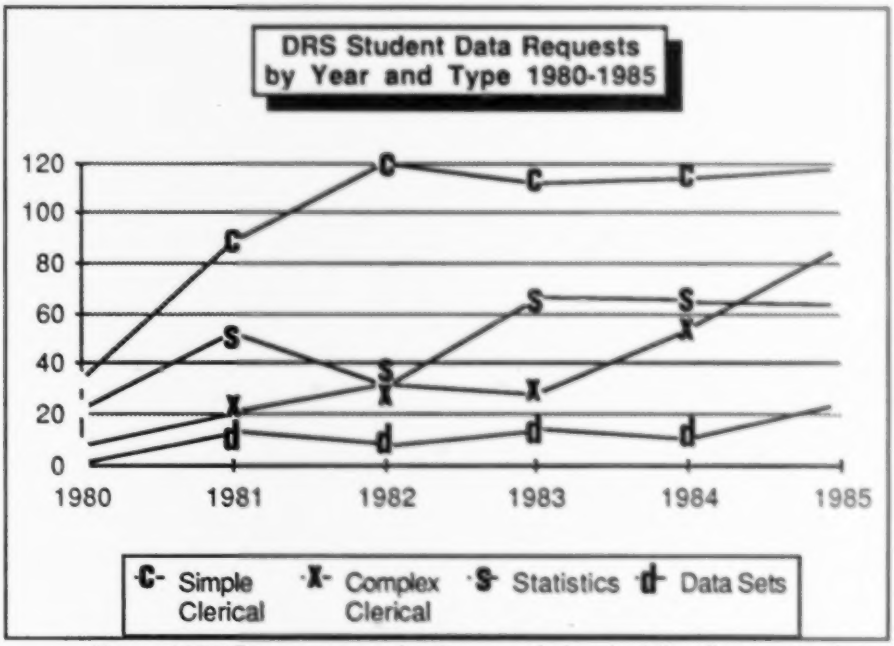
Chart 2



The chart shows that, over the five year period, the office's workload was evenly split between routine clerical requests and the other types of requests. routine clerical was the most frequent single request type. Summary statistics, the traditional institutional report, account for only a quarter of the requests. The other three-quarters of requests ask for data about individual cases. Up to this point, downloaded data sets have been a very small proportion of the office's output.

Chart 3 continues the analysis of request types by showing the trends in request types by year. The key trends have been a steady flow of routine clerical requests and an increase in complex clerical and statistics requests.

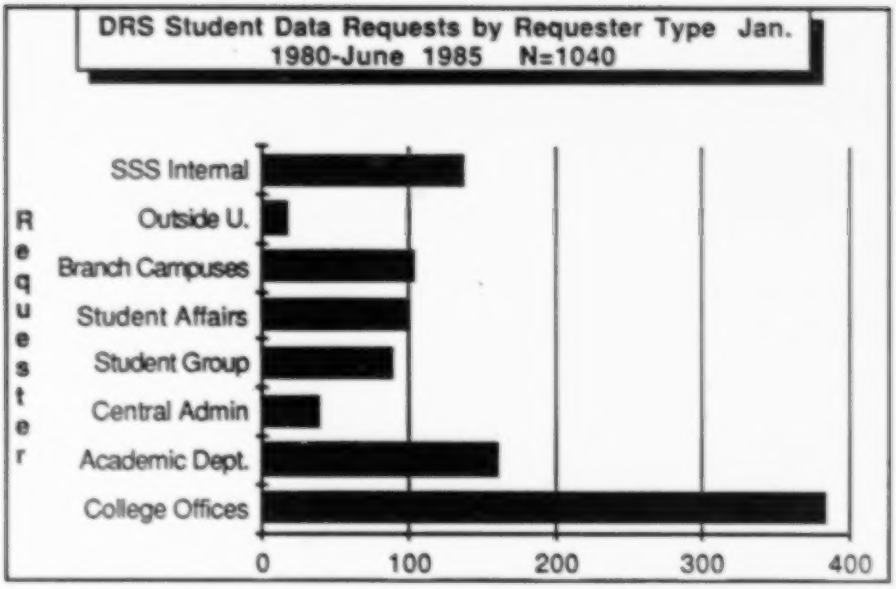
Chart 3



Note: 1985 figures are projections made by doubling figures for first 6 months of the year.

Chart 4 shows a different way of segmenting the information center market, by type of requester. The most frequent requesters of student data were academic units, constituent colleges and departments. At a large university, the college level administrative offices do much of the tracking of students and programming for them, explaining why college offices were the single biggest information user. Again, the traditional institutional research market, central administrative units, were much less of a factor in this information center market. Of the remaining categories, the SSS internal category refers to other units in the center's parent organization, Student Support Services, such as the admissions and records offices; student services refers to other units under the Vice President for Student Affairs; branch campuses cover all requests made from the university's coordinate campuses; and student groups include fraternities, honoraries and other student organizations.

Chart 4



After looking at markets segmented separately by request and requester type, the next logical step is to put the two segmentations together. Chart 5 shows the distribution of request types by requester type. Note that the chart is a 100% type. Each shading represents the percentage of a requester's total number of requests which is of a certain type.

Chart 5

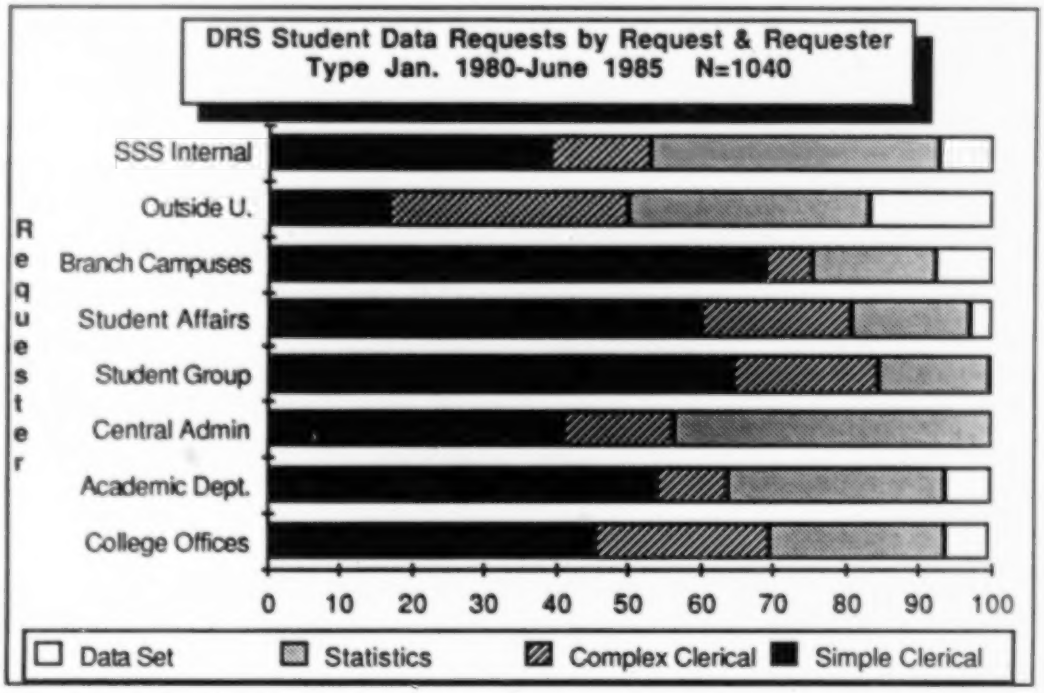


Chart 5 gives clues as to what kinds of campus users need what kinds of information. College offices, the most frequent requesters, are information omnivores--they request a balance of all types. Academic departments also

share the balance. Central administrative offices, as might be expected, rely heavily on summary statistics. Student Affairs, the branch campuses and student groups represent the opposite pole, requiring primarily routine clerical lists and labels.

To summarize the trends suggested by the analysis, it is clear that the student information business is flourishing; the clients of the information center include all the major campus constituencies; the bulk of the requests over the past five years have been for individual case data, either routine or complex. The routine clerical market has remained stable, while the markets for summary statistics and complex clerical reports has remained stable. The market for downloaded data sets has remained small and stable.

Trends in Information Delivery: Lessons from the Leading Edge

The small market seen so far for downloaded data sets is curious because it is discrepant with the proliferation of microcomputers. In less than a year and a half, a deep-discount microcomputer purchase program at the University of Minnesota has sold students and staff 9.5 million dollars worth of microcomputers. Virtually every academic department on campus has purchased or will soon purchase microcomputers. It seems obvious that this decentralization of computing power will soon force old-style information centers like Data and Reporting Services to become new-style information centers. As soon as administrators and their staffs become used to their computers and seek to justify their purchases, they will very much want to use their computers for manipulating student and other institutional data.

In preparing for the tide of download requests, it is instructive to consider the changes in delivery technology which have taken place in area which may be the state of the art in information centers--demographic data services. The demographic data industry has grown from a $5 million a year industry in the mid-70's to a $30-$50 million a year industry in the mid 80's. (Riche, 1985). Most major companies rely heavily on demographic data in making site and marketing decisions. For this reason, demographic analysis systems are often cited as examples of successful decision support systems (for example, Sprague & Carlson, 1985).

What have been the trends in demographic data technology? As described by Riche (1985), there has been rapid succession of technologies for delivering demographic data. Before the early 1980's, demographic data services were old-style information centers, offering clients data retrievals conducted by programming staff. Driven by users' desires for lower costs and more control, the services moved to giving users' on-line access to the reporting data bases. As microcomputers became available, many users pressed for downloaded data sets. Their motives were very businesslike. For frequent users the costs of downloading are lower than the on-line charges made for direct access to the databases. The biggest technological drawback to microcomputer analysis of demographics has been the limitation of file size imposed by microcomputer storage technology. This problem is being rapidly overcome by the development of optical disk technology. Already, one firm, National Decisions System, has begun to offer an optical disk database with 300,000 pages of census and other demographic information. While the costs of the optical disk technology is still relatively high, it will follow the inexorable course of other computer technology and quickly fall in price.

Today, all three types of delivery mechanism, programmed retrievals, on-line access, and downloading are offered in the marketplace and used by different customers. Occasional users tend to use programmed retrievals and

on-line services. Frequent users tend to use the downloaded data. The trend is definitely toward the use of microcomputers, especially as the computers become more powerful and storage becomes more capacious.

Along with the trend toward microcomputing, there is another trend, cutting across all segments of the demographic data industry: A growing need for analysis and interpretation services. Riche (1985) quotes Edward Spar, president of the Market Statistics data firm:

> "While technological change is a great opportunity for the industry, the important thing is still what you're going to do with the data. The big breakthrough will be in analytical retrieval: numbers in a format you can make decisions with. . . We try to find out what the client's problem is. . .We tailor a database to the clients problems, then sit down with a printed report and explain what the data mean."

Riche also quotes spokesmen for two other firms:
Dan Huck of CACI: "Our approach now is to provide more consulting. We have hired more market researchers. There is a big demand for more service in interpreting and applying the data.";
James Paris of Urban Decision Systems: "I think the industry has to do some educating. People buy numbers and don't know how to use them."

If one accepts the proposition that demographic data service represent the information center vanguard, then institutional researchers should be heartened. Far from being supplanted, as microcomputer databases proliferate, there is a good chance that the services of institutional researchers will be more in demand.

Note that the consultation being offered by the demographic data firms is different from the consultation services most often mentioned in discussions of information centers. When those with a data processing background (e.g. Torger, 1983) discuss consulting they are usually referring to helping users master their hardware and software. They are not referring to analytical consultations on the meaning of the data. The key element missing in many information center plans is precisely the one which institutional researchers can offer.

Conclusions: Different Markets Need Different Systems

Institutional research offices are in the position that demographic data services were in several years ago. They have been "old-style" information centers, responding to data requests with professionally programmed retrievals and research reports. They now need to convert to "new-style" information centers, recognizing the proliferation of microcomputer technologies. In doing so, they should consider appealing to underserved, non-traditional markets. At the same time, they should not abandon the traditional institutional research functions of data analysis and interpretation. The example of the demographic data services suggests that professional research and analytical services are needed more, not less, as end-users begin to manipulate their own data. The request records cited earlier suggest that there are three distinctive markets for student data, and perhaps for other kinds of institutional data as well. Each market is best served with different delivery systems:

I. The Routine Clerical Market. The largest market for information services on campus is for straightforward list processing. This is a "blue collar" market, populated primarily by departmental and collegiate clerical staffs. The needs of those in this market are to produce listings of information on subgroups of individual cases (student, faculty, facilities) ordered in a variety of ways. Typically, the offices in this market are understaffed and underfunded. The clerical staff in them want cheap, effective ways of lightening their large workloads. They want to do mailings and required reports faster and more efficiently than they could do by hand.

For this market, an optimal delivery mechanism is likely to be standard downloads of selected summary information on the cases of interest to the requesting office. In the case of student data, this means downloading for students in a given program or set of programs a set of demographic and summary performance data. The demographic data would include things like address information, sex and ethnic background. The performance information would include GPA's, cumulative credits and other summary indicants. With these data and appropriate microcomputer hardware/software, administrative staff can do mailings, dean's lists, uncomplicated probation reports, and a variety of other straightforward list processing applications.

A mainframe database system, accessed by individual users might be better than a system of frequent downloads. Certainly, it would have advantages in data currency and integrity. However, access charges would have to be set very low. Data and Reporting Services has served the routine clerical market at the University of Minnesota with mainframe programming, but it has subsidized some of the actual costs in retrieving the data through a low flat-rate billing policy. This market is large but comparatively poor. Most departments have put together the money to invest in microcomputers in the hope of gaining clerical efficiencies. But they have little left over to spend on programming, port, and on-line charges. Whether or not an institutional research office serves this market on a given campus is an local organizational question, but some information center definitely should serve it, and at low cost.

II. The Complex Clerical Market. The market for complex reports on individual cases is growing, and represents a good opportunity for institutional researchers to be of service. In the student area, college and departmental offices increasingly want to support effective advising and student service. For instance, they may need an advising report which breaks apart the student's coursework record and compares courses completed with degree requirements. Or the department may need to use complex criteria for identifying students on probation. Parallel examples probably exist in other data realms, such as faculty workload and performance.

The complex clerical market is best served by production reports or screens using mainframe databases. The programming is often complicated and is best done by professional programmers, espcially since inefficient programs of this type can be very expensive to run. Even if the programs are ultimately written by staff of administrative data processing departments, there is an important role for institutional researchers in serving this market. This role is that of "rapid prototyping". Rapid prototyping is a recent data processing concept (Connell and Brice, 1984) referring to the quick development of iterations of prototypes for production reports. The traditional way of developing production reports has been to go through an exhaustive process of defining external and internal specifications. The advantages of this process are precision and thoroughness, gained at the expense of speed, costs, and flexibility. Too often the process is completed, the programs are written, and after the first few runs, the client concludes that the program isn't exactly what's needed. The program then has to be expensively modified.

Rapid prototyping replaces the specifications definition process with a trial and error process of quickly devloping and running sample reports until they are right. Using extract files and fourth generation languages, the programmer plunges right in and does prototypes until they are right. The advantage of this approach is that the client can see a version of the "real thing" and can test its utility to the application for which it was intended. At its best, the process is more client-centered and faster than the traditional development process. At its worst, the process degenerates into sloppiness and inefficient programming.

Many institutional researchers are well equipped to do rapid prototyping because they know the issues, the data, and the software suited for rapid programming. They can talk to the user not just about the formats of the report, but also the problems the report will address, the experiences of other universities in dealing with the same problems, and alternative ways of accomplishing the task. They are used to working with clients whose needs are diffuse and whose specifications are ambiguous. The prototypes developed by institutional researchers may have to be recoded from scratch to run efficiently in production, but the process of genuinely defining client needs is usually well worth the effort. Ideally, institutional researchers would work together with programmers from data processing departments in meeting the client's needs. The researcher works with the client to prototype and settle report formats, and the programmer develops efficient code for the ongoing production of the report. In the process of prototyping, the researcher helps the client interpret and understand the data.

III. The Decision Support Market The market for summary statistics is growing, but is likely to remain smaller in volume than the market for data on individual cases. The market, however, is heavily populated with higher-level administrators who are looking for assistance with programmatic decisions. It is, therefore, a very important market.

The paramount requirements for systems to supply summary statistics are speed and applicability to the administrator's decisions. The data have to be the right data at the right time, or they are of little use. The decision support market is best served by a combination of old and new delivery systems. One promising new technique is the summary statistics database, available either on-line or on disk (Daly, 1985). The database contains a variety of summary statistics, which can be directly queried and manipulated by the administrator. Several higher education data services have begun to offer comparative statistics on a wide variety of insititutional data. The same thing can be done internally on a single campus, as illustrated by a pioneering effort at the University of California, Irvine (Daly, 1985). If it is well designed, such a database is likely to be more cost-effective than giving administrators direct access to large databases of individual cases.

Another technique worth considering is the "on demand" standard report. National data services have also developed this concept, offering the same data in the same format, but for selected groups of the requester's choice. For instance, the American College Testing Service or Educational Testing Service can supply standard marketing and test score reports for given subsets of a university's applicants. The advantages of the on demand standard report are efficiency because of pre-programming and the possibility of presenting standard interpretation guides along with the data. This is a way of fulfilling the need for analysis while still responding quickly to administrators' requests. Data and Reporting Services is currently developing a series of internal on demand standard reports, including student demographic profile reports and academic performance reports. Each will be available for custom subgroups of students, selected according to the client's specifications. Each report will be accompanied by an interpretation guide, explaining the nature of the data and its limitations.

Compared to data processing staff, institutional researchers are typically more adept at using the computing languages appropriate for summary statistics, namely statistical packages. Sometimes, data processing staff develop elaborate programs in third generation languages like COBOL to replicate formats and procedures that are easy options in SAS or SPSS.

Institutional researchers know the summary statistics market very well because they have served it for a long time. Thus the traditional ways of serving this market, the factbook and research report, should also be viewed as an important part of the information center scheme. It is very well to respond to develop new technologies to quickly produce data relevant administrators' ad hoc information needs. But it is even better to produce reports which anticipate information needs before they become apparent in a crisis.

Summary

Our experience has suggested that the market for administrative information can be segmented into several distinctive submarkets, each requiring different types of systems. These divisions are not mutually exclusive. A given end-user may be part of all three markets. In fact, there are many departmental users who are looking for the one system that will accomplish all their purposes in all three areas. In some cases, especially at smaller institutions, it may be posssible to fashion the single information system that optimally meets all three types of purposes ("The Ultimate Realized Database"). But in other cases, it is more likely that a combination of systems will be needed.

Insitutional researchers can play a very useful role in helping users develop the combination of systems that meets not only their technical requirements for data , but also their true, deeper requirements for intelligible and relevant information . Most institutional research offices have actually been information centers from the beginning, but they have been limited in that they have traditionally served only one of the major market segments. The new distributed computing technology suggests that institutional research offices should consider serving their traditional market in new ways, and think seriously about serving the other markets. The one thing all the markets have in common is the need for consultation on the meaning, uses, and limitations of the data. This is precisely the area where institutional researchers have the most to offer.

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